Outcome of Different Autogenous ACL Reconstruction in University Malaya Medical Centre

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ABSTRACT

Although not life-threatening, rupture of the anterior cruciate ligament (ACL) can severely impair activities of daily living and quality of life. ACL reconstruction is an accepted modality of treatment but failure rates as high as 25% have been reported [1]. In view of this, we reviewed the clinical outcome of 33 patients who had undergone arthroscopic-assisted autogenous graft reconstruction using either patella-tendon or hamstring graft following anterior cruciate ligament (ACL) rupture in UMMC between 2000 to 2003. This study was also conducted to compare the outcome of the two different types of autogenous graft used for ACL reconstruction which are the bone-patella tendon-bone (BPB) and hamstring (HS) grafts. Patients between the ages of 17 to 48 years (mean age of 27.8 years) were evaluated at 1 to 3 years post-operatively using various clinical parameters which include functional index, subjective and objective scores and an objective measurement using KT 1000 arthrometer. On the overall, patients operated in our centre did well with 6% (n=2) failures reported. Both the BPB and HS groups had good to excellent results post operatively. Ninety seven percent (n=32) of the patients were able to kneel and squat with more than half of them achieving >90% single-legged hop test. Eighty eight percent of patients (n=29) achieved normal to nearly normal subjective IKDC score. The mean Lysholm score was 92.2, with 97% (n=32) scored excellent (80 points or more). More than 90% had equal or less than 2 Tegner activity-level drop. The mean KT 1000 side to side difference was 1.71mm, with 94% had less than 4mm difference. Even though the BPB group was observed to have a higher mean Lysholm score (92.6%) compared to the HS group (91.8%), they were statistically significant. The BPB group had a significantly less residual laxity with the KT 1000 side to side different of 1.1mm compared with the HS group of 1.9mm. However no correlation between laxity and any of the outcome scores were noted. In conclusion, ACL reconstruction procedures performed in UMMC have yield good to excellent short term results.

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INTRODUCTION

Ligamentous injuries to the knee account for up to 40% of all knee injuries.[1, 3, 5, 9, 13, 15] The incidence of ACL tears varies with the population studied. The ACL is the most frequently disrupted ligament of the knee and is injured 9 times more frequently than the posterior cruciate ligament.[2]

ACL is a stabilizer of the knee joint. It controls the forward motion as well as medial and lateral rotation of the tibia on the femur. Rupture of this ligament impairs the stability of the knee resulting in decreased athletic performance and increased risk of early degenerative joint disease.[2] ACL reconstruction has been advocated to improve knee stability and to reduce the incidence of meniscal injury.

A number of substitutes for ACL reconstruction have been used and tested, including autograft, prosthetic ligament, allograft and graft with prosthetic augmentation. Extra-articular reconstruction has also been described as a method of stabilization, however have not been popularized.[3] Autografts using patellar tendon or hamstring tendon have been the preferred graft of choice for reconstruction.[3] The functional outcome after ACL reconstruction using these grafts have been questioned and the superiority of one graft versus the other often debated.

In Malaysia, surgeons' preferences on the choice of autografts are generally limited to the two with operation conducted in this country dating back as far as 1983. Despite this fact, reports regarding the outcome of ACL reconstruction and comparison of either choice are still scarce. Therefore, this study was conducted to determine the overall outcome of ACL reconstruction performed in UMMC and to compare the outcome of two different ACL reconstruction techniques i.e. using bone patella-bone (BPB) and hamstring (HS) graft.

MATERIALS AND METHODS

We reviewed patients who underwent ACL reconstruction between January 2000 and December 2003, using either bone patellar tendon bone substitution or hamstring graft in University Malaya Medical Center. Patients with prior reconstruction, multi-ligament reconstruction, avulsion fracture, allograft reconstruction

and contralateral anterior cruciate ligament insufficiency or reconstruction were excluded from this study. Meniscal injury was not excluded from the study. Forty four patients fulfilled this criteria however only thirty three patients were available for clinical evaluation based on the minimum requirement of 1 year post-operative assessment. The remaining 10 patients were lost to follow up.

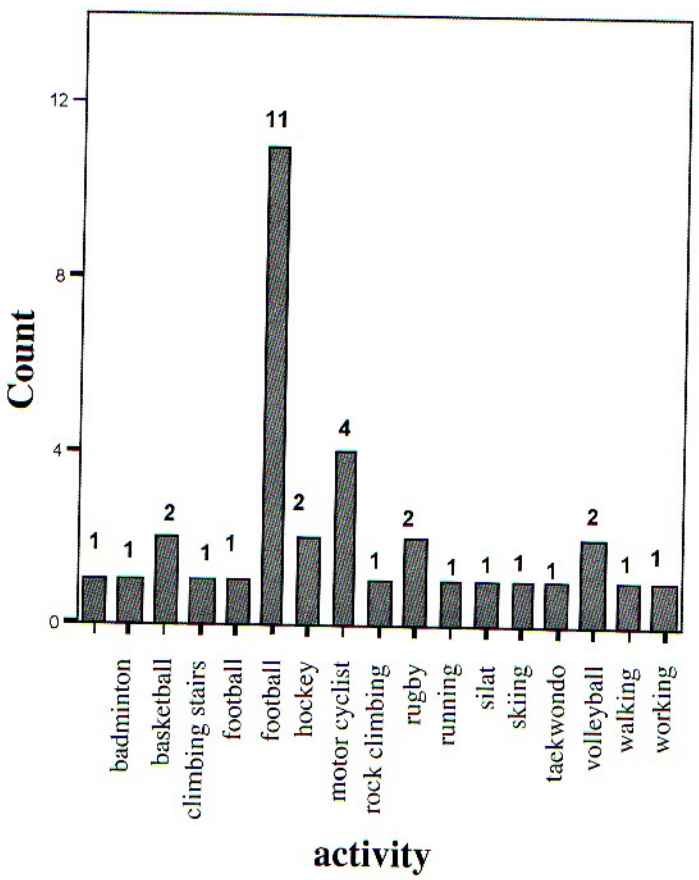
Clinical evaluations of the available reconstructions were conducted at UMMC or their homes. A detailed history of the injury and other assessment performed which include squatting and kneeling ability, thigh girth measurement and antero-posterior laxity of the knee. Lysholm Knee Scoring System, Tegner Activity Score and the IKDC ligament standardized evaluation form were used for subjective assessment as well as clinical and functional evaluations for all patients. A single-leg hop test was performed in patients as a functional test. Degenerative changes of the knee were clinically assessed and investigated using radiograph.

Results were analyzed using a statistical package for the social sciences (SPSS) 10. Descriptive statistics, chi-square analysis and independent t-test were employed where applicable.

RESULTS

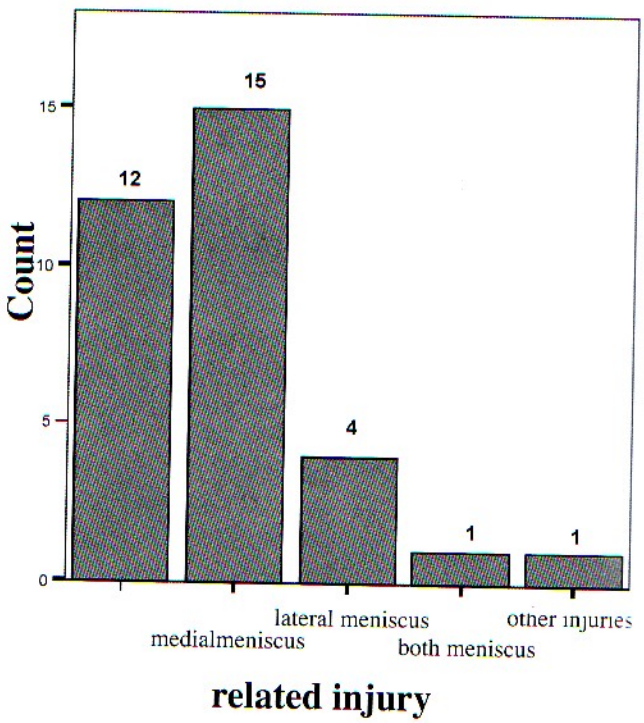
Fifty one percent of the patients were Malays, 27% Chinese and 21% Indian. The highest numbers of patients' injury were the result of sporting activities with football (79%) contributing the largest number, followed by basketball (Table 1).

Table 1: *Distribution of causes to ACL rupture in our series.*



Thirty six percent of ACL reconstructed patients had isolated ACL tear with no other associated injuries. In cases where associated injuries were established, medial meniscus injury was involved in 45% of cases (Table 2).

Table 2. *The number of cases with associated knee injury. Note that in 60.6% (n=20) of cases will have some form of meniscal injury.*



Ninety seven percent were able to squat and kneel, more than half of the subjects achieved >90% of the single-leg hop test. Almost 90% achieved normal to nearly normal subjective IKDC scores. More than two thirds of the patients had 90 scores and above for their Lysholm objective scores with the mean of 92.2 and one third scored a full 100 marks. For the Tegner activity score, more than 90% had equal or less than 2 levels drop. Ninety percent had normal to nearly normal overall IKDC scores. Almost 90% of the patients had less than 3mm KT 1000 side to side differences.

Table 3 describes the results outlines of both BPB and HS group. In this study, BPB group was observed to have a higher mean Lysholm and overall IKDC score but the differences were not statistically significant (Paired-T test: p value > 0.05). There was significantly less residual laxity with AP laxity difference of 1.1mm in the BPB group compared to the HS group of 1.93mm (Paired-T test; p value=0).

Table 3 : *Comparison of results between BTB and HS grafts.*

Test	BTB (n=19)	HS (n=14)
1. Functional Index		
• Squatting (Yes)	95% (n=18)	100%
• Kneeling (Yes)	95% (n=18)	100%
• Hop-test (>90%)	58% (n=11)	50% (n=7)
2. Subjective scores (normal IKDC)	86% (n=16)	93%(n=13)
3. Objective scores		
• Lysholm (scores of more than 90)	74% (n=14)	79% (n=11)
• Mean Lysholm Score	92.7	91.8
• Normal IKDC	79% (n=15)	86% (n=12)
4. KT 1000 (< 3mm difference)	100%	86% (n=12)
Mean KT 1000 difference	1.11mm	1.93mm

Complications of both procedures were compared side by side. In comparing the percentage of complications of BPB versus HS group, there are a higher number of reported post operative complications noted in the BPB group (78.9% versus 64.3%) (Table 4). However, this value is not representative of as the number of cases as one patient may have more than one complication. However from table 4 it is worthy to note that there were two ruptures of grafts in the BPB group while none were reported in the HS group.

Table 4: *Post-operative complications.*
The total numbers of complications were not representative of the overall percentage as one patient may have more than one type of complications.

Type of graft/Complications	BPB N=19	HS N=14
Recurrent rupture	2	0
Wound infection	0	1
Secondary procedure	0	1
Anterior knee pain	5	3
Stiffness	2	4
Harvest Site Pathology	6	0
Total no.	15	9

DISCUSSION

Students make up more than a third of UMMC's ACL reconstructed patients. Both football and basketball are the type of sports which are highly associated with ACL injuries due to involvement of cutting and pivoting movements. These figures were quite similar to Western literatures.[3,9,10,12]

Autograft is the main choice of grafts in our centre with BPB being the graft of choice accounting for 58% of the cases. The reason for this choice was unclear but may be related to the fact that BPB grafts are easier to harvest than hamstring grafts. In contrast, harvesting hamstring graft may be daunting to the inexperienced surgeon; the tendon may be difficult to isolate and identify because they are concealed beneath several tissue layers.[9,11] The patellar tendon is located subcutaneously which is quite easy to harvest. The two difficulties that surgeons must overcome when harvesting hamstring grafts are identifying the semitendinosus & gracillis tendons and avoiding premature

tendon amputation. In a poll of members of the Australian Knees Society in 2000, surgeons in Australia were found to prefer the use of autograft with 98% employing both patellar tendon and hamstring graft in certain circumstances while the remainders were evenly divided in their preference for 'only' patellar tendon or 'only' hamstring.[4] Members of the ACL Study Group showed an almost similar perspective, with 73% choosing the patellar tendon, 23% hamstring and 4% others (e.g. allograft). This trend has not change when compared to a similar survey conducted 2 years earlier.[5] Another survey of orthopedic surgeons caring for American Football teams in the major leagues showed all but one surgeon preferred autologous patellar tendon grafts.[6]

BPB grafts usage was observed to give better functional results and significantly less residual anterior knee laxity. A prospective randomized controlled trial involving 32 patients for duration of 5 years in Oxford University (BPB = 14, HS = 18) showed that the BPB group had higher IKDC score and more favorable squatting and kneeling result, however there was no statistical significance between the two groups.[7] Eriksson K *et al.* 2003, reported that in 164 patients with an average follow-up of 21 months, showed no difference in the outcome in both BPB and HS group despite the BPB group having slightly decreased extension compared to the none operated side.[8] In contrast, a Singapore group in 2003 evaluated 32 patients at 24 months post-reconstruction *(BPB=17, HS=15) and found the IKDC score for 60% of* patients in HS group were good to excellent as compared to only 46% in the BPB group. However, a higher percentage of patients demonstrated knee laxity in the hamstring group (86.7%) in comparison to 76.5% in the BPB group. They also found that post-reconstruction weakness of hamstring muscles was noticeable in the HS group based on the Biodex and endurance testing at 2 years of follow-up.[9]

A meta-analysis conducted in 2002 from 594 relevant articles regarding ACL reconstruction from 1980 to May 1997 suggested that the patellar tendon group was better than hamstring group in return to pre-injury level of activity.[10] Seventy five percent of the BPB returned to activity earlier as compared to 64% in the HS group.[9] In three studies that included pivot shift testing, the patellar tendon patients were less likely to have a pivot shift of > 0 (p=0.05; 60% of BPB patients versus 25% of HS patients). They had therefore concluded that ACL reconstruction using the patellar tendon was more successful in allowing patients to return to pre-injury level of activity and in reducing laxity compared with the hamstring tendons technique.[10]

ACL ruptures are often combined with meniscal tears and if left untreated will lead to degenerative changes of the knee.[11,12] A few studies have reported good results after meniscal repair.[13-15] However, not all meniscal tests are repairable and partial meniscectomy has been considered acceptable for complex meniscal test. It is worth noting though that in many studies even partial meniscectomy can lead to degenerative changes of the knee.[16-23] In our study, ACL-injured patients with associated meniscal injuries were observed to have a higher abnormal scores of IKDC results (66.7%) as compared to those patients with isolated ACL injury (33.3%). Similar finding were noted by Eriksson K *et al.* 2003.[8] Patients with associated meniscal injuries had lower IKDC, visual analog ($p<0.01$) and Lysholm scores ($p<0.05$) than those without such injuries. Tow *et al.* 2004, from Singapore found that of the patients who had meniscectomy, 53% scored poorly by IKDC evaluation compared with 36% which did not undergo meniscectomy.[9] Studies have shown that an ACL reconstruction can improve the symptoms of cartilage damage and previous meniscectomies, provided that the stability of the reconstructed knee is mantained.[24,25] Burks et al 1997, reported that in their 15-year follow-up study of partial meniscectomy stable knees with meniscectomies do better than unstable knees with meniscectomies.[18] Other than pain, degenerative changes ensue partial or subtotal meniscectomy.

Infection is a rare complication following knee arthroscopy and ACL reconstruction with reports ranging between 0.1% to 0.42% for arthroscopy alone and 0.3% to 0.48% after ACL reconstruction.[26,27] Only 1 patient in our series developed superficial infection which resolved after a week course of oral antibiotics. Although the incidence is low, infection can lead to devastating outcomes, including loss of the graft, arthrofibrosis and early degenerative joint disease.

Current literatures do not reveal any definitive management scheme for the treatment of infected reconstructed ACL. A recent questionnaire given to sports *medicine fellowship directors, reflected 5 different options* chosen as the initial treatment of infection after ACL reconstruction.[26] The most frequently selected treatment was irrigation and debridement with graft retention followed by intravenous antibiotics. If the infection appeared resistant, many surgeons chose graft removal as the treatment of choice. Additionally, if reimplantation was to be performed, a delay of 6 to 9 months after removal of the infected graft was recommended.[26, 27]

Anterior knee pain following BPB reconstruction of the ACL have been well documented.[28-34] The use of hamstring tendons for the graft is generally thought to reduce the incidence of such pain. There have, however, been conflicting reports in the literature.[35,36] Pain and discomfort on kneeling are very common and this may be troublesome in those patients whose job and lifestyle involves kneeling.[35] A neuroma of the infrapatellar branch of the saphenous nerve may cause considerable symptoms. Patellar tendinitis has been reported in patients after harvest of the patellar tendon. However, in most cases this pain settles with time.[34]

In this study, 5 out of 19 patients from the BPB group developed anterior knee pain compared with 3 out of 14 patients in the hamstring group. The knee pain was typically described during kneeling especially in those who performs prayers. It was also frequently described during climbing upstairs. Harvest site pathology was the tenderness elicited at the site of tendon harvest during physical examination. Six out of 19 patients from the BPB group had tenderness at the harvest site whilst none was noted in the hamstring group.

The patellofemoral joint is a very vulnerable structure and chondromalacia can be a problem as a consequence of the injury, the surgery or due to postoperative

immobilization. Chondromalacia may be inevitable in some patients after a serious injury to the knee. Harvesting the patellar tendon usually results in patella damage despite care during surgery. [34] This also alters the biomechanics of patellofemoral mechanism. It has been suggested that strict adherence to a vigorous and aggressive rehabilitation regime will reduce the incidence of postoperative patellofemoral problems.[19] This suggestion is also important to achieve and maintain full extension for the well-being of the patellofemoral joint.[30]

The incidence of stiffness varies (depending on the definition) but problems with loss of movement have been reported in up to 24% of cases.[28] In this study, more patients from the hamstring group developed stiffness (4/14) compared with the BPB group (2/19). Only 1 patient developed arthrofibrosis. She had early hamstring reconstruction due to concomitant menisci injury. Sachs et al 1989, carried out a survey of 50 prominent knee surgeons who had published papers in the field of reconstruction of the ACL.[28] From the 40 who replied, flexion contracture was the most common complication after ligament surgery. It is associated with a high level of patient dissatisfaction and is very frustrating for the patient, surgeon and physiotherapist.[28] Patients with severe involvement were unable to regain flexion despite undergoing arthroscopic debridement.

Rupture of the graft may occur because of either a new injury or a technical error in insertion, usually poor placement of the tunnel or inadequate notchplasty leading to impingement.[12] These causes were not the reason for the rupture in our series. Two patients from the BPB group were clinically diagnosed with recurrent rupture. One of them had an early return to competitive sports activity in less than 6 months whilst the other one defaulted post-operative rehabilitation and had another fall during recreational sports activity. It has been recommended that return to active sports should be done gradually and fully after 9 months.[32]

CONCLUSION

The overall outcome for the ACL reconstruction in UMMC has generated good to excellent results regardless of the choice of grafts. Functional, objective and subjective results were generally good. Both BPB and hamstring grafts gave good functional results therefore he type of graft does not significantly influence the final outcome of ACL reconstruction. The mean side-to-side residual laxity is 1.71mm which is comparable to the mean laxity difference between the knees of a normal Malaysian population of 1mm. Although hamstring grafts have significant residual laxity compared to bone patella-bone grafts, it does not reflect the clinical outcome.

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